

ABSTRACT

An element for reflecting, transmitting, focusing, defocusing or wavefront correction of electromagnetic radiation in the terahertz frequency range. The elements include a grid of conductive strips including active regions comprising a chalcogenide phase change material. The chalcogenide material can be in an amorphous, crystalline or partially crystalline state. The dispersive characteristics of the grid (e.g. impedance, admittance, capacitance, inductance) influence one or more of the reflection, transmission, state of focusing or wavefront characteristics of incident electromagnetic radiation through the action of a stored phase taper formed by establishing a crystallinity gradient over a series of active chalcogenide regions or domains in one or more directions of the element. The dispersive characteristics of the grid are determined by the structural states of the active chalcogenide regions contained therein and are reconfigurable through transformations of one or more chalcogenide regions from one structural state to another by providing energy to the chalcogenide material. In a preferred embodiment, the individual active chalcogenide regions are much smaller than the operating wavelength of the element so that a plurality of active chalcogenide regions is included in wavelength scale domains. In these embodiments, crystallinity gradients may be formed through monotonic increases or decreases in the domain average fractional crystallinity in one or more directions of an element where no particular requirement on the fractional crystallinity of individual active regions need be imposed. In these embodiments, the domain fractional crystallinity is a statistical average over the individual chalcogenide regions contained therein and phase tapers may be achieved in multistate or binary mode. The element may be free-standing, supported on a dielectric substrate or interposed between two or more dielectric materials.